REMARKS

Favorable reconsideration is respectfully requested.

The claims are 11-20.

The above amendment to claim 13 corrects a self-explanatory editorial error and support is evident at pages 14 and 15 as well as the specific examples.

The specification has already been amended in this manner, per the Preliminary Amendment of December 28, 2001.

The above amendment also corrects claim 17 in a self-explanatory manner.

Claims 11-13 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al. (US 4,751,146) in view of Hanson (US 5,863,446).

Further, claims 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Maeda et al. in view of Hanson, as stated above and further in view of Gannon (US 5,916,401).

These rejections are respectfully traversed.

Maeda et al. (US 4,751,146) disclose a print circuit board comprising a laminate of (A) a thin-wall body containing a cross-linked product of a mixture of an ethylenic copolymer (A) and an ethylenic copolymer (B), and (B) an electrically conductive metal layer (claim 1). Further, Maeda et al. disclose a thermosetting resin layer (claim 2), a heat-resistant thermoplastic polymer layer (claim 3), a glass cloth or mat, an aramid fiber sheet and a ceramic sheet as a component of the print circuit board.

Maeda et al. also disclose the use of an inorganic filler having a thermal conductivity of 1×10^{-3}cal/°C or more and an electrical value 10^{10} Ω cm or more as a component to be incorporated in the mixture of copolymer (A) and copolymer (B).

However, Maeda et al. do not disclose or suggest the method of forming a penetration hole for a through hole in a thermosetting resin copper-clad laminate having at least two copper layers by means of the pulse oscillation of a carbon dioxide gas laser. A copper-clad laminate of the present invention is for use in such method.

Hanson (US 5,863,441) discloses a method for laser drilling blind-vias in a laminated substrate (col. 3, lines 11-12). When the laser emits at a wavelength of 355 nm or 266 nm, the energy density

per pulse applied to the substrate for drilling a through-via is greater than 2 J/cm^2 and preferably 10 J/cm^2 (col. 4, lines 15-23). Hanson discloses that the choice of laser is important to his invention. The preferred lasers are pulsed solid state lasers such as the frequency-tripped Nd:YAG laser emitting at a 355 nm wavelength or a frequency-quadrupled Nd:YAG laser emitting at a 266 nm wavelength (col. 11, lines 14-19) and discloses to enhance the quality of a via entrance, the use of a polymeric photo-absorptive layer on an exposed top surface of the laminated substrate (col. 4, lines 23-27).

The differences between the present invention and Hanson are stated below.

a. The present invention uses a carbon dioxide gas laser emitting at a 9.3 - 10.6 μm wavelength. To the contrary, Hanson uses a UV-YAG laser emitting at a 355 or 266 nm wavelength.

b. It was known that a UV-YAG laser can form a penetration hole by irradiating a copper foil surface of a thermosetting resin copper-clad laminate. Hanson states a polymeric photo-absorptive layer is formed on an exposed top surface of the laminated substrate in order to enhance the quality of the via entrance, that is, the polymeric photo-absorptive layer is not necessarily only for forming a penetration hole.

<u>In contrast, when a carbon dioxide gas laser is irradiated onto a copper foil surface without an auxiliary material of the present invention, no holes were made</u> (see Comparative Example 1 on page 26 of the present specification).

In the present invention, the use of an auxiliary material is essential and the auxiliary material contains at least one powder selected from the group consisting of a metal compound powder having a melting point of at least 900°C and a bond energy of at least 300 kJ/mol, a carbon powder and metal powder.

Anyone of ordinary skill in the art could not expect the suitability of the auxiliary material of the present invention, which uses a carbon dioxide gas laser, for forming a penetration hole.

c. The energy density per pulse in the invention of Hanson is 2 to 10 J/cm^2 for a pulse. The through-vias have via entrances of 75 μm or less. The diameter of a beam of UV-YAG laser is 25 μm. It is not possible to form a hole which has a diameter smaller than 25 μm. Therefore, Hanson discloses a method to form a hole which has a diameter of 25 μm to 75 μm. The required energy to form a hole of 25 μm is 0.0098 to 0.049 mJ/a hole of 25 μm and ahole of 75 μm is 0.029 to 0.15

mJ/a hole of 75 μm. The required energy to form a hole in the present invention, which uses a carbon dioxide gas laser, is in contrast 20 to 60 mJ/a hole of 80 to 180 μm.

Thus, as stated above, a carbon dioxide gas laser of the present invention and UV-YAG laser of Hanson have completely different properties.

Gannon (US 5,916,401) discloses an application of a conducting or semi-conducting coating onto a non-conducting substrate, typically glass of curved or complex shape (col. 1, lines 5-8), that is, discloses a method of applying a coating to a glass substrate, a non-conductive substrate.

Gannon does not disclose or suggest the auxiliary material of the present invention which is used for forming a penetration hole by means of oscillation of a carbon dioxide gas laser. Gannon does not provide any suggestion of using a water-soluble polymer in the present invention.

In view of the different objectives and features of the cited references, it is not seen why one of ordinary skill in the art would combine them for any reason no less to arrive at the present invention.

For the foregoing reasons, it is apparent that the rejections on prior art are untenable and should be withdrawn.

No further issues remaining, allowance of this application is respectfully requested.

If the Examiner has any comments or proposals for expediting prosecution, please contact undersigned at the telephone number below.

Respectfully submitted,

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